

WASHINGTON

SCIENCE TRENDS

HIGHLIGHTS

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Aircraft Nuclear Propulsion

Radical change in management of the beleaguered Aircraft Nuclear Propulsion program is now being discussed by the Pentagon and the Atomic Energy Commission. Officials favoring the project fear that reorganization of the type contemplated might again delay progress.

* Program Management: Hearings before the Research and Development Subcommittee of the Joint Committee on Atomic Energy served to highlight the conflicting judgments and objectives of the ANP program. The Air Force, the Atomic Energy Commission and the Joint Chiefs of Staff were shown to favor an "early flight" goal while the Department of Defense, and to some extent, the Navy, favored additional work on advanced reactor and material concepts.

Change in management of the program will probably follow the retirement next month of Maj. Gen. D.J. Keirn, a firm advocate of "early flight" in his personal statements and as AEC-Air Force program director.

Several alternatives to the present management system are now under study. It was learned that the plan currently favored would shift direction of the project to a large industrial or non-profit organization operating under a management-type contract. The arrangement would be somewhat similar to that used by the AEC for operation of its Sandia facilities, or that used by the Air Force for direction of its ballistic missile program.

Another possibility is the appointment of a civilian "czar" for the program. He would presumably work under the AEC with a deputy representing the Navy and another representing the Air Force. This system, according to critics, would give the Navy a co-equal -- and therefore larger -- voice in the program.

Program Status: Dr. Herbert F. York, Director of Defense Research and Engineering, states that for "the immediate future" the Pentagon will continue the development of only such reactors and power plants as would be suitable for militarily useful nuclear flight. Efforts will be increased on the Pratt and Whitney indirect cycle reactor system "so as to determine its potentialities at an earlier date than previously contemplated." This apparently means a set-back for the GE "fly early" direct cycle reactor, although work will be continued on an advanced materials version of the GE system.

Automatic Programming of Digital Computers

Army Signal Corps is working on a compiler, which in effect, writes compilers - a fast, cheap and efficient means of producing specialized compilers to handle special, easy to learn technical vocabularies with a strong common language basis. It is intended that these compilers will translate programs written in a particular "technical language" into an object program for the desired computer.

* Possible Field Applications - Army Study Groups are currently completing detailed analyses of anywhere from 54 to 106 different areas of possible field applications of Automatic Data Processing Equipment. According to one estimate, this number may be extended into the thousands within the next 10 to 20 years.

* Difficulty of Programming - The Army believes that it will be virtually impossible to gather together the hundreds of programmers required to write the programs for field applications. Time and effort in such a process would also be considerable. In addition, programs must be suited for computers available today to the Field Army as well as machines which will be used in future years. There is also the serious "patchwork" problem of accommodating changes in the running programs.

* Automatic Programming Language - The Signal Corps hopes to eliminate these difficulties with an Automatic Programming Language for all Army Computer Programs.

It is contemplated that a limited compiling routine can be written which will accept a problem stated in a more-or-less "universal computer code." Then, utilizing subroutines already available, an effective object program can be produced, for a specific machine or class of machines.

* "Technical Jargon" -- The Automatic Programming Language will consist of many subsets which might be termed "technical jargons" in the same sense that chemists or plumbers or artists use a jargon -- a subset of the English language.

The Automatic Programming system is expected to provide an automatic method of translating from any "technical jargon" to some "universal" type or class of languages, in which all problems may be expressed, and which any computer can understand when provided with a limited compiler. The sum total of the special purpose languages or jargons, with their special compiling routines make up the Army Automatic Programming System.

* Advantages - Here are some of the expected advantages of the system, as reported to Army Science advisors:

"Since all problem-solving programs will be reduced to some 'universal' class language, by retaining an intermediate translation, it will be possible in an extremely short time to reproduce an object program not only for your own machine, if your running programs are destroyed but for any other computer which might be available should your computer itself be destroyed...Changes can be made in the original statement of the problem and then quickly and cheaply recompiled...New 'jargons' can be added to take care of future applications...with an absolute minimum of effort..."

Special Report - Solid Propellant Research

Advanced Research Projects Agency is spending some \$18 million this Fiscal Year in basic and applied research on solid propellant technology. Funding in seven broad areas during Fiscal Year 1959 totalled some \$15 million for exploration in new high-energy solid propellants and supporting projects. Here, for reference, is a new and official catalog of research projects and contractors:

- * Basic Objective: The basic objective of the ARPA program is the discovery and development of improved solid propellants with useful energy 10 to 20 percent above those propellants now being used.

It is expected that these new solid propellants would be sufficiently energetic, as compared with those presently available, to allow substantial increases in range, increases in payload, or reduction in overall weight of missiles and space systems. An increase of 20 percent in energy would almost double the warhead-carrying potential of future solid engine ICBM's, according to ARPA studies.

ARPA claims "close coordination" between its own solid propellant programs and those of the individual services which are associated with current missile systems.

Here is how the 1959 program has been apportioned over 54 contracts:

- * Integrated Programs: \$6,000,000

The integration program concept involves thermochemistry, thermodynamics and performance estimates; chemical studies aimed at the synthesis of new ingredients; propellant formulation and compounding; and the study of the properties of the final propellant including ballistic and mechanical properties all in a single contract.

The primary criterion for the selection of these contractors was the caliber and suitability of the scientific personnel available. The concept involves the definition of the research program in terms of the objective rather than in terms of ways and means of attaining the objective.

Contractors: Minnesota Mining and Manufacturing; American Cyanamid, Dow Chemical and Esso Research and Engineering.

- * Propellant Performance: \$1,720,000

A substantial program has been set up involving the selection and assembly of best thermodynamic values, performance calculations based upon these values and kinetic studies aimed at the elucidation of processes which occur during expansion. These studies are providing a "firm basis" for the selection of these areas of chemistry which are most likely to contribute substantially to the desired goals.

Contractors: National Bureau of Standards, University of California, Ohio State, Arthur D. Little, Bureau of Mines, Allegany Ballistics Laboratory, Aeronutronic Systems, Inc., Rohm and Haas, Atlantic Research Corp, University of Chicago, University of Wisconsin.

* Specialized Synthesis: \$3,840,000

The work under the integrated programs involves a large percentage of synthetic work. However, the necessity for new ingredients, if the objectives are to be achieved, recommends the placement of contracts concerned solely with synthetic work.

This type of program will enable the Department of Defense to obtain the services of laboratories especially highly qualified in certain branches of synthetic chemistry of special pertinence.

The principal areas covered in the specialized contracts for synthesis already placed or planned include: New oxidizers, new light metal fuels and research directed towards new chemical techniques.

Contracts: Magna Products, Penn State, Duke University, New York University, University of Florida, Wright Air Development Center, Rohm and Haas, Naval Ordnance Station, Olin Mathieson, Allied Chemical, Callery Chemical, Monsanto Chemical, Pennsalt, Borden, Peninsular Chemresearch, Ethyl Corp., Atlantic Research Corp. and National Research.

* Propellant Research: \$750,000

The new ingredients which are expected to become available as a result of the synthesis programs are likely to have properties quite different from those now used. This would recommend that new compounds be made available as quickly as possible to all major propellant research centers.

However, it is also essential to preserve the Government's interest, according to ARPA, by seeing to it that compositions involving new ingredients do not become proprietary if the research is Government-sponsored. It has been decided that initial work on the use of new ingredients would be confined to certain laboratories which are "free of proprietary restrictions."

Laboratories: Ordnance Missile Laboratory, Naval Ordnance Test Station, Picatinny Arsenal, Naval Propellant Plant, Jet Propulsion Laboratory and Rohm and Haas, Redstone Division.

* High Temperature Research: \$1,900,000

Present day high performance solid propellants have flame temperatures in the vicinity of 5,000°F. Propellants now under development may be substantially hotter and accordingly, subject the inert parts to extreme conditions. It is necessary to have a research program designed to solve this problem.

The research program planned involves the mechanism of ablation, properties of refractories, insulation studies and the pyrolysis of organic polymers. These programs are meant to study fundamental knowledge as to the resistance of inert components to high temperature.

Contracts: Applied Physics Laboratory, Allegany Ballistics Laboratory, Union Carbide Corp., Cornell Aeronautical Laboratory, Atomics International, AVCO Manufacturing, General Electric, National Bureau of Standards.

* Basic Research: \$873,000

A variety of basic research programs involving many pertinent to the overall objective were set up through the basic scientific office of the three Services. These programs include a study of detonation, the study of burning rate of solid propellants, metastable systems, ductile ceramics, ceramic-fiber alloys and various spectroscopy studies of combustion processes.

Contracts: Bureau of Mines, Brooklyn Polytech, University of California, Princeton University, Aerojet-General Corp. Aerochemical Research Laboratory, University of Texas, Stanford Research, Materials Research Corp., and Vanderbilt.

* Non-Destructive Testing

ARPA is currently reviewing this program and expects to announce decisions shortly. Due to the fact that solid fuel engines are becoming successively larger every year, an ever-increasing demand has been placed upon the mechanical properties of the propellant.

Failures such as cracking, separation from the liner and areas of porosity are likely to occur. These faults can increase the burning surface over that expected, leading to unpredictable and occasionally disastrous pressure increase. Additionally, ARPA states, certain faults may expose the wall surfaces of the engine to high temperatures prematurely, leading to failures at operating pressures.

Accordingly, an advanced solid propellant program should include a substantial effort on techniques for non-destructive testing and inspection. Failure criteria need to be developed and instrumental methods for the detection of faults require a great deal of refinement. These subjects are now being studied for future funding.

* Space Agency Patents

First Congressional Hearings on the controversial patent provisions of the National Aeronautics and Space Act may be held before Congress adjourns in the next few months. Preliminary investigation of the subject will be made by a House Subcommittee under Rep. Erwin Mitchell, (d) Ga. - in response to criticism directed to NASA patent regulations by various legal organizations and industries.

The patent provisions, adapted from the Atomic Energy statutes, were inserted in the Space Act without prior Congressional hearings. Now, industry and patent law spokesmen will have an opportunity to comment.

Boron Distribution

Atomic Energy Commission is transferring responsibility for the commercial distribution of boron-10 materials, enriched up to 92 percent in the isotope B-10 to the Lockland Ohio Aircraft Reactors Operations Office. (Details on the boron-10 program are available from Lockland Office, P.O. Box 23, Lockland Branch, Cincinnati, Ohio, and from Union Carbide Co., Isotopes Sales Dept. P.O. Box X, Oak Ridge Tennessee.

PUBLICATION CHECKLIST

- () Civil Defense, a comprehensive Congressional report on Civil Defense doctrine and preparations in Western Europe and the Soviet Union. 109 pages. Single copies free. (Write Committee on Government Operations, House of Representatives, Washington 25, D.C. for Civil Defense -- House Report No. 300)
- () Government Space Organization, the observations of the Congressional group headed by Sen. Stuart Symington (d) Mo. which tried in vain to find a solution to the space maze. 58 pages. Single copies free. (Write Committee on Aeronautical and Space Sciences, Subcommittee on Governmental Organization, Senate Office Building, Washington 25, D.C., for Report, Space Activities)
- () Government Organization Manual, the 1959-60 edition of this handbook is now available, outlining the functions and activities of each Agency and listing more than 4,200 key officials. Always a "best seller" for anyone dealing with the Government. 803 pages. \$1.50. (Write Superintendent of Documents, Government Printing Office, Washington 25, D.C.)
- () Soviet Scientific Information, a revised survey on science information in the U.S.S.R. and on Soviet Publications available in the U.S. Includes information on bibliographies, translations, dealers and similar matters. 36 pages. Single copies free. (Write Public Information Office, National Science Foundation, Washington 25, D.C. for "Providing U.S. Scientists with Soviet Scientific Information".)
- () Electronic Designers Handbook, a new electronic designer reference manual said to be the first to be devoted exclusively to shock and vibration environments. Includes theory, philosophy, protective devices and similar material. Published by Wright Air Development Center, Dayton, Ohio. 250 pages. (Available to Department of Defense Contractors through Armed Services Technical Information Agency. ASTIA Document No. AD-204095)
- () Science Glossaries, a new bibliography listing 1,043 glossaries of scientific terms in 26 languages. \$2.50. (Write UNESCO Publications Center, 801 Third Avenue, N.Y., for "Bibliography of Monolingual Scientific and Technical Glossaries".)
- () Reliability of Military Electronic Equipment, a comprehensive 1957 handbook just reprinted by popular demand. Covers such subjects as basic test requirements, test procedures, pilot-production standards, packaging, storage effects and maintenance. 377 pages. \$1.75. (Write Superintendent of Documents, Government Printing Office, Washington 25, D.C. For Pub. No. D 4.2:El 2/3)
- () Lithium Metals, a technical data sheet outlining various properties and selected values chosen from the published literature. 8 pages. Free. (Write Foote Mineral Co., 18 W. Cheltenham Avenue, Philadelphia 44, Pa. for Technical Data Bulletin 101)
- () Science and Government, testimony, statements and exhibits presented before a Congressional Committee studying proposals for a Department of Science and technology. 213 pages. Single copies free. (Write Committee on Government Operations, Subcommittee on Reorganization, Senate Office Building, Washington 25, D.C. for Hearings - S. 676 - Part II)

